IN THE CLAIMS

1. (currently amended) A method of determining a gap between an eddy current proximity transducer and a target, said method comprising:

providing a data structure that is populated with data that is relative to a ~~plurality of~~ gap ~~value~~ values corresponding to a plurality of complex impedance ~~value~~ values of the transducer;

exciting the transducer at a plurality of different frequencies;

determining a plurality of complex impedance ~~value~~ values of the transducer at a ~~respective one~~ each of the plurality of frequencies; ~~and~~

determining ~~the gap~~ a plurality of gap values using the data structure and the plurality of complex impedance ~~value~~ values; and

determining the gap using the plurality of gap values.

2. (currently amended) A method in accordance with Claim 1 wherein the data structure includes a look-up table that is populated with data that is relative to at least ~~one~~ two of the plurality of excitation frequencies, said method further comprises determining a plurality of gap ~~value~~ values based on interpolating data in the look-up table.

3. (currently amended) A method in accordance with Claim 1 wherein the data structure includes a look-up table that is populated with data that is relative to each of the plurality of excitation frequencies, said method further comprises determining a plurality of gap ~~value~~ values based on interpolating data for each respective frequency.

4. (currently amended) A method in accordance with Claim 3 wherein determining the gap comprises averaging the plurality of gap values.

5. (original) A method in accordance with Claim 1 wherein exciting the transducer at a plurality of different frequencies comprises exciting the transducer at a plurality of different frequencies substantially simultaneously.

6. (original) A method in accordance with Claim 1 wherein exciting the transducer at a plurality of different frequencies comprises exciting the transducer at three different frequencies substantially simultaneously.

7. (original) A method in accordance with Claim 6 wherein determining a complex impedance value of the transducer comprises determining a respective complex impedance value of the transducer at each of the three frequencies substantially simultaneously.

8. (original) A method in accordance with Claim 1 wherein determining the gap using the data structure and the complex impedance value comprises determining the gap in real-time using the data structure and the complex impedance value.

9. (original) A method in accordance with Claim 1 wherein the data structure includes three look-up tables that each include data relative to one of the plurality of excitation frequencies, and wherein determining the gap using the data structure and the complex impedance value comprises determining a gap value at each excitation by interpolating data in each respective look-up table corresponding to each complex impedance value.

10. (original) A method in accordance with Claim 9 wherein determining the gap comprises averaging the gap values.

11. (currently amended) A system for determining a gap between an eddy current proximity transducer and a target, said system comprising:

a network comprising said transducer serially coupled to an electrical component;

a signal generator circuit operatively coupled to said network, said signal generator circuit configured to drive a current that includes a plurality of frequency components three selectable and programmable direct digital synthesis devices each device configured to generate a plurality of frequencies through said network wherein a first analog voltage is impressed across said network and a second analog voltage is impressed across said transducer;

a sampling and digitizing circuit coupled to said signal generator circuit, said sampling and digitizing circuit configured to convert the first analog multi-frequency voltage

impressed across said network and said second analog multi-frequency voltage impressed across said transducer into a plurality of digitized voltages;

a convolution circuit comprising an input terminal corresponding to at least one of the plurality of ~~component~~ frequencies, said convolution circuit configured to convolve each digitized voltage with a digital waveform for forming a first complex number and a second complex number correlative to the first analog voltage and the second analog voltage respectively for at least one of the ~~component~~ frequencies; and

a memory comprising a data structure corresponding to ~~at least one~~ each of the ~~component~~ frequencies, said data structure populated with data that is relative to <u>a plurality of</u> gap values based on at least one of the first complex number and the second complex number.

12. (original) A system in accordance with Claim 11 wherein said transducer includes a serially coupled cable and wherein said second analog voltage is impressed across a serial combination of said transducer and said cable.

13. – 16. (canceled)

17. (currently amended) A system in accordance with Claim ~~13~~ <u>11</u> wherein said signal ~~conditioner~~ <u>generator</u> circuit includes a current source configured to generate a multi-frequency current.

18. (currently amended) A system in accordance with Claim ~~13~~ <u>11</u> wherein said convolution circuit comprises a digital circuit configured to receive at least one ~~component~~ frequency on an input channel that is selectively tuned to the respective frequency.

19. (currently amended) A system in accordance with Claim ~~13~~ <u>11</u> wherein said convolution circuit comprises a programmable digital circuit configured to receive each ~~component~~ frequency on a separate respective input channel that is selectively tuned to the respective frequency.

20. (currently amended) A system in accordance with Claim ~~13~~ <u>11</u> wherein said convolution circuit comprises a digital down counter configured to receive at least one ~~component~~ frequency on a separate respective input channel that is selectively tuned to the respective frequency.

21. (canceled)

22. (currently amended)   A system in accordance with Claim ~~13~~ <u>11</u> wherein said memory comprises a look-up table corresponding to each of the ~~component~~ frequencies, said look-up table populated with data that is relative to gap values based on at least one of the first complex number and the second complex number.

23. (currently amended)   A system in accordance with Claim ~~13~~ <u>11</u> further comprising a processor configured to correlate the first complex number and the second complex number for at least one of the ~~component~~ frequencies to respective gap data in said data structure.

24. (currently amended)   A system in accordance with Claim 23 wherein said processor is configured to correlate the first complex number and the second complex number for at least one of the ~~component~~ frequencies to respective gap data in said data structure by interpolation.